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REPORT

OF THE

TOPOGRAPHICAL SURVEY COMMISSIONERS

1898

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FROM

Mass. commissioners
of topographical survey.

14 March, 1899.

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Commonwealth of Massachusetts.

REPORT OF THE COMMISSIONERS

ON THE

TOPOGRAPHICAL SURVEY.

FOR THE YEAR 1898.

BOSTON:
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The Commissioners

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REPORT.

BOSTON, MASS., Dec. 31, 1898.

To the Honorable Senate and House of Representatives, Commonwealth of Massachusetts.

The Commissioners on the Topographical Survey and Map of the State present the following report of the work executed under their direction during the year 1898.

Owing to the large amount of extra work which has devolved upon the department in the defining and establishing of two State boundary lines and investigating a third, the regular town boundary survey has been somewhat interrupted. A force has, however, been kept steadily employed during the year in town boundary surveys and preparing the results for publication. The delay in issuing the atlases has allowed us to improve the form for publication previously adopted.

Early in the year new quarters were assigned to the commission in the State House, Rooms 137 and 138, and on July 1 the employees were moved from the old offices at 11 Mount Vernon Street to the State House. This change

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has resulted in furnishing facilities for doing the work of the department in an efficient and economical manner, especially in connection with the draughting division. The old rooms at the top of the Commonwealth building were poorly adapted to the requirements of the survey, and a large amount of valuable material was exposed to destruction by fire.

An important undertaking has been begun during the past year by the United States Geological Survey. There has been for some time a wide demand for a good map of the metropolitan district, and our suggestion to the director of the United States Geological Survey that the old topographical sheets surrounding Boston should be revised met with a prompt response. Mr. Frank Sutton, one of the experts on topography connected with the United States Geological Survey, was assigned to the work with a party of assistants, and we hope that before the end of another year the map will be completed. A large amount of excellent material was collected from surveys which have been made in the metropolitan area during the past ten years by different State and municipal departments. The old offices of the commission at 11 Mount Vernon Street were assigned to this work.

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We have been enabled during the past year to keep the field parties at work until the middle of November, which is about a month longer than usual, which has resulted in greater economy in the execution of the surveys.

The report of the chief engineer, Mr. Henry B. Wood, will be found in the Appendix.

Rhode Island Boundary.

In the last annual report a brief history of the Rhode Island line was given, together with a description of the work accomplished on the new marking to Jan. 1, 1898. Soon after the above date a number of consultations were held between this Board and the commissioners representing the State of Rhode Island, and in the early part of March a definite agreement was arrived at as to the line and its marking.

Both the Massachusetts and the Rhode Island laws required us to follow "as near as may be" the line established by the decree of the United States Supreme Court in 1861. After careful determinations of the old line by triangulation and of the topography, it was thought best to change the old line slightly at a few points, and it was to these changes that the greater part of the studies were directed.

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The old boundary line between Massachusetts and Rhode Island from the "Burnt Swamp Corner" to the sea was not marked at several important points, but no difficulty was found in ascertaining the position of these points, and on March 30, at a joint meeting held at this office, the following conclusions were reached:—

1. That the monuments between Pawtucket and Attleborough, along the northerly line of Pawtucket, be set on the straight line as run from the bound at Blackstone river to "Bound 1" on the Ten Mile river.

2. That for the old boundary line following the Seven and Ten Mile rivers there be substituted a series of six straight lines, as shown on plan.

3. That from the bolt at Runnin's river, southerly, the middle of the river shall remain as the boundary line as far as the point where it intersects the straight line from "Birch Swamp Corner" to the Barrington-Seekonk Corner, produced northwesterly to the middle of the river.

4. That the intermediate monuments in the straight lines from the Barrington-East Providence-Seekonk Corner to "Birch Swamp Corner," and from "Birch Swamp Corner" to the bolt in bowlder at Mount Hope Bay, be set so as to be in line between the corner monuments.

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5. That the line from "Birch Swamp Corner" to the "bolt in bowlder" be produced until it intersects the high-water line on the west shore of Mount Hope Bay. Also that the Fall River-Tiverton line be produced until it intersects the high-water line on the east shore of Mount Hope Bay, and that the boundary line across Mount Hope Bay shall be a line joining these two points of intersection, and that monuments be set at each end of said line.

6. That the line between Fall River and Tiverton from Mount Hope Bay to South Watuppa Pond remain as now marked, except that intermediate monuments on the straight lines be set so as to be in line between the corner monuments.

7. That the line from "Bound A," southerly on the South Watuppa section to "Bound F," at the southern extremity of Sawdy Pond, consist of six straight lines.

8. From "Bound F" to "Joe Sanford's" bound, and thence to Peaked Rock at the Atlantic Ocean, the line be surveyed by triangulation, as marked by the bounds at the points described by the decree of 1861, and reported upon before deciding as to what shall be done with the line.

In carrying out the second conclusion in the above agreement, as authorized by the statute,

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something over 100 acres were taken from Massachusetts and given to Rhode Island, but an equivalent amount of territory was taken from Rhode Island and added to Massachusetts on the South Watuppa section.

At the southerly end of the Runnin's river line a portion of the line was cut off by extending the straight line from Monroe's Corner to "Birch Swamp Corner," to an intersection with the Runnin's river section, and a new corner was by this means established in the Runnin's river, thus simplifying the line.

From Bound 124, corresponding with "Bound F" of the old line, to Bound 127 at "Joe Sanford's" bound, and thence to the Atlantic Ocean, the remainder of the boundary line was retained exactly as established in 1861.

After the commissions had established the line, it was determined to mark the corners with bounds 9½ feet in length and 12 by 12 inches in section, with faces dressed 3 feet down from the top; it was also determined that these bounds should be set 5½ feet in the ground, and that (Mass.) should be cut on one face, (R. I.) on another, and (1898) on a third face, — the letters to be 5 inches high and the figures 4 inches high, all to read from the top of the monument downward.

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BOUNDS USED ON THE RHODE ISLAND LINE.

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Proposals for furnishing these bounds were opened on April 18, at which time the contract was awarded to D. H. Reed of Fitzwilliam, N. H., at $14.45 per bound.

All road crossings were also monumented, either with old bounds found on the line or with new bounds like those at the corners, except that they were 10 by 12 inches in section.

In September the bounds were all set, and later the triangulation completed and maps made. These are now awaiting the signatures of the commissions.

A special report of the details connected with this boundary line will soon be made to the General Court, as required by the Acts of 1897.

In brief, it may be said that, owing to the able co-operation of the Rhode Island commissioners, and the excellent organization of the engineering parties who carried out the work, the line was promptly determined, and speedily, and we trust permanently, marked.

New York Boundary Line.

We take much satisfaction in reporting that since the date of the last annual report the line forming the boundary between New York and Massachusetts has been agreed upon, and the

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northerly half of the line has been permanently marked.

After an agreement had been reached with the authorities representing New York in regard to the establishment of the line, it was further agreed that one-half of the line should be marked by each State with suitable bounds. The northerly half of the line fell by lot to Massachusetts and the southerly half to New York. The authorities of the latter State hope to complete their part of the monumenting during the present year, and as soon as this has been done a complete map of the line and a full report will be made to the Legislature, as required by the act of April 1, 1897.

The following brief account of the work accomplished, together with a description of the line adopted and partially marked, may not be out of place in this report:—

The westerly boundary of Massachusetts, with the exception of a very small portion at the southerly extremity, is a straight line 47.2 miles in length, as determined by the survey of 1898. The difficulties incident to developing a perfectly straight line of this length upon the ground can only be known to those who have undertaken a similar task.

A preliminary study showed that points which

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were supposed to be nearly on the line established in 1787 could not be wholly relied upon; and it was determined to adopt for the preliminary survey a base line which would represent as nearly as possible an average of the old stone piles and other marks to be found. By running out this average line with the greatest possible accuracy, and connecting it with all the marks that could be found along its length, it was anticipated that some more favorable line could be found to represent the permanent line. At the beginning of the year this preliminary line had been determined upon the ground for about two-thirds of its length.

Owing to the fact that the appropriation for the continuation of the work on the part of the State of New York was delayed, it was not until June 23 that the joint survey was continued.

As Mr. Sidney Smith, who had charge of the Massachusetts party last year, was otherwise engaged, Mr. Eugene E. Peirce was selected to take his place as our representative, under the direction of the chief engineer.

Early in August the survey was finished, and careful studies and inspections of the line were made by this Board, in conjunction with the State engineer of New York, ending in a con-

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ference on August 9 at Williamstown, at which the engineers of both States were present.

It was finally determined that the base line, which had been run with so much care, was so near to the probable line adopted in 1787 that it was difficult to determine how it could be materially improved. There was some evidence that it was 1.9 feet too far to the east at the southerly extremity, and perhaps a few feet too far to the west at the northerly extremity; but, as there was more or less of uncertainty in regard to this evidence, and as the base line which had been defined at so much expense passed through the old 14th transit point at Rhode's Pinnacle, it was agreed to adopt that line as the permanent boundary.

The following is the full text of the agreement: —

1. It is agreed that the line to be marked by stone monuments and otherwise, as the jurisdictional line between the State of New York and the Commonwealth of Massachusetts, shall be as follows: —

Beginning at a point at the northwest corner of Connecticut, marked by a stone monument; thence running westerly about forty chains, to a marble monument now standing at the southeast corner of the territory known as "Boston

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Corner," ceded by Massachusetts to New York in 1853; thence running about north, twelve degrees, fifty-seven minutes, sixteen seconds west, to a stone monument standing at the side of Roberts Road, so called; thence deflecting slightly to the west and running in a straight line toward a marble monument known as the "Hogeboom Monument" on Alander Mountain, till it intersects the base line of the survey just completed from Alander Mountain to the southerly line of the State of Vermont; thence the line follows the base line of the aforesaid survey to the southerly line of the State of Vermont.

2. It is agreed that the line shall be marked by placing stone bounds at each end of said line and at all angles in the same.

3. Stone bounds shall be placed at such prominent points along said line as shall be agreed upon by the engineers of the parties thereto.

4. Stone bounds or other marks shall be placed at the end of each mile, measuring from the point of beginning.

5. Stone bounds shall be placed at the intersection of said boundary line with all roads and railroads.

It is further agreed that the stone bounds which have been prepared by the State of New York for marking the line shall be used for marking the mile points so far as practicable.

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At such summits and mile points, where it is not practicable to place stone bounds, a cast-iron post shall be used, secured into the rock, wherever practicable, and supported by pyramids of stones laid in cement, — the design of the iron bound to be prepared by the engineer of the Topographical Survey Commission, who shall also have charge of procuring the bounds.

At the road crossings and summits, where stone monuments can be delivered at a reasonable expense, bounds similar to those now being placed on the boundary line between Massachusetts and Rhode Island are to be used, provided they can be obtained from the party now furnishing the Rhode Island bounds, at the present price.

It is further agreed that at the Shaker Village Road the old 1818 stone monument, now lying on the ground alongside of the line, shall be re-set on the line, in addition to a new road stone.

At the intersection of the State line with all town corners, the existing corner bounds shall be re-set at such intersection, first obtaining the assent of the town authorities thereto.

It is agreed that none of the bounds now standing as marks of the State line are to be disturbed, except where new bounds are to be set in the exact location of the old ones.

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BOUNDS USED ON THE NEW YORK LINE.

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It was subsequently arranged that, for convenience in monumenting the line, the Massachusetts party should set one-half the bounds and the New York party the other half, each State to pay all the expenses of setting the bounds on its half of the line. By lot, the northerly half of the line fell to Massachusetts.

Immediately after the above agreement had been made, directions were given to the engineers to monument the Massachusetts half of the line as expeditiously as possible.

A contract was made with Mr. Kenneth MacKay of Valley Falls, R. I., for setting the bounds, and early in September the work was begun. On November 4 the chief engineer reported that the monumenting had been completed. The number of bounds set was 55. As some of the stations where bounds were to be set came at points very difficult of access, a special cast-iron mark was arranged for such places.

Reference was made to the care with which this straight line was determined, and a brief description of the method of alignment may prove of interest.

In order to secure as long a line of sight as possible, an effort was made to throw a heliotrope flash from Mount Misery to Mount Alander, — a distance of 37.8 miles; and, after a number of efforts, the engineers were successful. With

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an instrument on Mount Alander and this foresight on Mount Misery, intermediate points were established with remarkable accuracy, and the extremities of the line were afterwards established by the usual transiting methods.

Some of the important points were afterwards connected with the triangulation system of the State, and the computations so far made show these points to be on a straight line. If, after careful revision, this long straight line and the triangulation system are found to agree, it will be a most interesting confirmation of the accuracy of modern geodetic work.

The final report of the engineer on this boundary line will cover details of all the methods employed.

Connecticut Boundary Line.

The following resolve was approved on March 29, 1898: —

[Chapter 39, Resolves of 1898.]

Resolve to provide for the examination of the boundary line between the commonwealth of Massachusetts and the State of Connecticut.

Resolved, That the commissioners on the topographical survey and map of Massachusetts are hereby directed to cause a preliminary examina-

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tion to be made as to the present condition of the monuments or marks defining the boundary line between this Commonwealth and the state of Connecticut, and to confer with the authorities of the state of Connecticut as to the re-marking of said line, if such re-marking is found to be necessary. Said commissioners shall include in their next annual report a statement of the results of their examination and conference, together with an estimate of the cost of re-marking the line in a substantial and permanent manner. For the purposes of this resolve, said commissioners may expend a sum not exceeding five hundred dollars.

The total distance from the northwest corner of Rhode Island to the northwest corner of Connecticut, in a straight line, is about 87 miles, and the total length of the boundary line is about 95 miles.

As a preliminary to carrying out the provisions of the above resolve, a circular letter was sent to the clerk of the selectmen of nineteen towns bordering on the Connecticut line, for the purpose of obtaining a statement from them as to the condition of the bounds and markings of the State line, and whether it had been recently perambulated, or not. The answers to these letters showed that the majority of the town lines

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had not been perambulated for many years, and in some cases the records did not show when the last perambulation had been made. In a number of cases where perambulations had been made, the selectmen of the opposite town in Connecticut were reported as not co-operating with the selectmen making the perambulation.

The Connecticut line is naturally divided into two portions, — that east of the Connecticut river and that west of the Connecticut river.

The portion east of the river was surveyed by commissioners in 1826, and bounds established. Many of these bounds, however, are found to be defective, and a few are missing. The report of our engineer shows that there are 75 points on this portion of the line where bounds should be set, if all the angles in the line, all the town corners, prominent summits, railways and highways are to be marked in a permanent manner. As all of the other State lines are now marked by permanent granite monuments, it is recommended that 50 points along this line should be marked by new granite monuments, and that 25 of the old stones should be re-set. This portion of the line is very nearly straight, and the location of the corners can generally be definitely determined, although the marks are in a decidedly poor condition.

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The portion west of the Connecticut river was marked in 1803, and is in a much worse condition. There are a number of slight angles in the line, and many of the bounds at the corners cannot be found. More than one-half of the bounds at the highways are missing, and it seems probable that a careful study of the line may result in improving it at a few points, if the authorities of Connecticut should concur. In this portion of the line there are about 100 points that require to be marked. There are 20 old bounds that could be re-set, leaving 80 new bounds to be furnished. It is recommended that this portion of the line be surveyed, and that the town corners and prominent summits throughout the whole line be marked, and then connected with the triangulation system of the State.

The total cost of re-marking the whole line is estimated at $14,000, of which one-half should be borne by each State.

As required by the provisions of the resolve, conferences have been held with the authorities of Connecticut. The matter is now in the hands of the Governor of that State, who is to bring it to the attention of the Legislature at its present session.

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Town Boundaries.

In connection with the town boundary survey the commission have been engaged in extending and completing the primary triangulation of the State. The following important stations have been occupied and added to the system during the present year: —

Clarksburg,	Berlin Mountain,	Mount Misery,
Perry Peak,	Mount Harvey,	Mount Prospect,
Mount Alander,	Bald Peak,	Prospect Hill, Conn.

All of these points except Bald Peak and Clarksburg in Massachusetts and Prospect Hill in Connecticut were either on or very near to the westerly boundary of the State.

The field work of the primary triangulation is now entirely completed, unless it be found necessary in the future to strengthen some of the interior points by additional observations. Mr. Jas. B. Tolley, who has been in charge of this portion of the work, has, with the permission of His Excellency the Governor, gone again to Washington to complete the adjustment of several points in the triangulation system, in consultation with and acting under the advice of the officials connected with the United States Coast and Geodetic Survey. We hope to estab-

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lish the primary work of Massachusetts on the most accurate basis that it is possible to obtain.

In connection with the regular town boundary work, we have arranged for a systematic examination of all the legislation which has taken place in regard to the fixing of town lines. This information is compared with the boundaries as accepted and perambulated by the local authorities, and they show in some cases decided differences in the lines; sometimes a corner duly established by law is omitted, and sometimes a witness monument is regarded as a corner, when the true corner may be in the centre of a stream. In other cases several bounds have been found near to each other, and careful study has been necessary to determine which was the legal boundary. In doubtful cases we have been guided by the advice of the law department of the Commonwealth. On March 11 we received a carefully prepared written opinion from the Attorney-General on a complicated case connected with the line between Lexington and Cambridge, which was selected as a type of certain difficulties arising in the fixing of town boundaries.

As the law requires that streams or natural bodies of water forming boundaries should be surveyed, we have directed our engineer to survey the boundary lines of certain towns where

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streams or other natural features formed a portion of the boundary. Assistant Tolley and party during the year revised the following town boundaries in Middlesex and Suffolk counties: Chelsea, Everett, Malden, Medford, Melrose, Revere, Winthrop. The long line between Boston and Brookline, from Chestnut Hill Reservoir to St. Mary's Street, has been surveyed. Mr. Tolley's party has also done a large amount of other work in connection with town boundaries.

Mr. Eugene E. Peirce, in charge of one of our parties has been largely employed in State boundary work, but he has also determined some important boundaries in connection with towns in Essex and Plymouth counties.

Mr. William C. Hawley, in charge of another party, has been engaged on special work, such as the determination of the Milford-Holliston line, where one of the town boundary corners was found to be about 150 feet from its true position. Mr. Hawley has also completed some work on the Marlborough sheet, in accordance with a request from the United States Geological Survey.

In the draughting department, in charge of Mr. Frank L. Tibbetts, a large number of plans have been made during the year, both in connection with the State boundaries and the town

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boundary work. Twenty-three double elephant plans, with index sheet, have been prepared to file with the Rhode Island boundary line report.

Sixty photographic reductions of shore lines have been received from the United States Coast and Geodetic Survey, for use in the delineation of the town boundaries on the sea.

The principal computations in connection with the work of the survey during the past year have been made by Mrs. Edna M. Peirce and Mr. W. C. Hawley.

In connection with the atlases which are soon to be published we have been fortunate in securing the services of Miss Sara A. Holt, who has rendered valuable assistance in compiling records from the archives in the State Library and in arranging the information in convenient form for reference.

Respectfully submitted,

DESMOND FITZGERALD,
ALFRED E. BURTON,
FRANK W. HODGDON,
Commissioners.

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APPENDIX.

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APPENDIX A.

REPORT OF THE CHIEF ENGINEER.

BOSTON, MASS., Dec. 31, 1898.

Mr. DESMOND FITZGERALD, *Chairman, Topographical Survey Commission, Boston, Mass.*

DEAR SIR: — I beg leave to submit the following report of field and office work accomplished during the year 1898: —

RHODE ISLAND BOUNDARY LINE.

The surveys of the most important sections of the line were completed during the field season of 1897, and the original field plans were made while the work was being done. There remained to be completed this year the survey of a few straight-line sections of the line and of the Runnin's river; also the selection on the ground of points suitable for the bounds, and the setting of the monuments.

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Attleborough-Cumberland Line.

Early in January advantage was taken of the leaves being off the trees to make a reconnoissance of the Attleborough-Cumberland line, to find the best points of control from which to check the location of Bound 1 or "Burnt Swamp Corner," which was the initial point of the line. A few summits between it and the Blackstone River bound were located, to correct the alignment of the previous season's work, and the offsets from the theoretical straight line were computed. By using these offsets as a basis, hubs were set where it was desired to place the bounds.

The field work proper began on March 14.

The old monuments were found to be a short distance west of the State line, and were moved on to line.

There were used in marking this line:—

New corners,	2
New road stones,	12
Old State line stones reset,	8
Old groove stones reset,	11
New small or groove stones furnished and set,	4

The monument at "Burnt Swamp Corner," having been set firmly in concrete, was left in its original position, 1898 being cut on the top.

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Attleborough-Pawtucket Line.

The old State line stones were found to be a few feet north or south of the line, and were all moved on to line. The corner monument, Attleborough-Pawtucket-Seekonk, was moved 40 feet easterly on this line produced to a point where the newly adopted line ran south. In doing this, the bound was placed in good firm soil.

There were used in marking this line: —

New corners,	1
New road stones,	2
Old State line stones reset,	5
Old granite monuments, lettered "A" on one side and "P" on the other,	6

Ten Mile River Section.

Many old bounds were missing, and some were found from 400 to 1,050 feet off the old line. A series of straight lines were substituted for the line of highest water mark of 1861. These lines were placed on the topographical map made last year, after having been agreed upon by the commissioners of both States, and were then run out on the ground. Hubs for the corner marks were first located from the old base line, and after the monuments were set, tall signals were erected over the monuments, and

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were located from the neighboring triangulation stations. Their positions thus determined were found to agree with the theoretical positions adopted. The lines between these corners were then run out, and points for the road stones stationed and the monuments set.

There were used in marking this line: —

New corners,	7
New road stones,	2
Old State line stones reset,	11
Old groove stone reset,	1
New small stones furnished and set,	1

Bolt at Runnin's River.

This bound, referred to in the decree of 1861, was an iron bolt in the north end of the middle pier of the bridge at Warren Avenue over Runnin's river. This bridge is an old one, and will be probably replaced before many years. When this is done, a more permanent mark should be placed at this point. Two line stones were placed on line a little north of the bolt, by means of which the position of the point at the bridge can be easily re-established.

Runnin's River Section.

A stadia survey was made of this river to a point where the line running northwesterly from Birch Swamp Corner to Monroe's Corner (the

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Barrington-Seekonk-Swansea-Warren line) produced intersects the centre line of the river. The State line follows the centre or middle of the river, "as the same is at low water."

The only bound necessary was a new corner witness monument, which was set on the East Providence-Seekonk line, 115 feet from the true corner towards Monroe's Corner, to mark the change in the line at this point agreed upon by the commissioners.

Runnin's River to Mount Hope Bay.

The old stones on this line were found to be two or three feet south of the line, and were moved on to line.

The old monuments of 1861, at Monroe's and Birch Swamp Corners, were found, and the copper bolt in the bowlder at Toweset. A new granite monument was set in place of the copper bolt in the bowlder at Toweset. It is at the mean high-water line, and is protected by riprap. The old monument near it was moved back 340 feet, and set on the line at a point easy of access for relocating the line, in case the bound at the bay is disturbed by ice.

There were used in marking this line: —

New corners,	4
Old State line stones reset,	12
Old groove stones reset,	8

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The Line across Mount Hope Bay.

The line across Mount Hope Bay being changed to connect points on the *high* instead of the *low* water line, a new corner bound was erected on the Fall River-Tiverton line, at the high-water line on the east shore of Mount Hope Bay, and was protected by riprap.

Fall River-Tiverton Line (extending from Mount Hope Bay to South Watuppa Pond).

The old points identified and retained on this line were the monument on the east side of the New York, New Haven & Hartford Railroad, in the centre of South Main Street; one on the southerly shore of Cook's Pond; one in the centre of the Eight Rod Way; and one in the line of highest water on the west shore of South Watuppa Pond. The old monuments and road stones, being very near to these lines, were moved on to line.

There were used in marking this line: —

New corners,	2
Old State line stones reset,	2
Old groove stones reset,	2
New small stones furnished and set,	1
Iron bolts set in ledge,	2

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South Watuppa and Sawdy Ponds to "Joe Sanford" Bound.

The joint commission substituted 6 straight lines for the line of high water of South Watuppa and Sawdy ponds. The new corners were approximately located upon the ground from the old base line, and monuments were set, after which, by means of tall signals, their positions were accurately determined by triangulation.

Many of the monuments referred to in the decree of 1861 were not found, and the stone at Bliss Road was found to be 200 feet too far east. Road stones were moved on to line. "1898" was cut on the monument at the north end of this section, which had been firmly reset in concrete masonry the previous year.

The old "Joe Sanford" bound, marked by a bolt in a small bowlder, was replaced by a granite monument set in concrete masonry.

There were used in marking this line: —

New corners,	5
Old State line stones reset,	3
Old groove stones reset,	1

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"Joe Sanford" Bound to the Sea.

The monuments at the corners in this line were determined by triangulation, and a stadia survey of the village of Adamsville and the road southerly was made, by which it was discovered that the line intersected a portion of the road at two points where it was necessary to place new bounds. The old road stones found to be a few feet off the line were moved on to line, and a new monument was set in place of the old monument at "Peaked Rock" near the ocean, the line extending about 785 feet southerly to an unmarked point at the intersection with the high-water line.

There were used in marking this line: —

New corners,	1
New road stones,	3
Old State line stones reset,	3
Old groove stones reset,	2

The old State line stone at Adamsville Dam was reset in concrete masonry.

Where old State line stones were reset to mark corners throughout the entire line, the date of setting was cut on the stone.

In marking the entire line, 39 substantial granite monuments were used, cut to the new design approved by the joint Board, and such

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old monuments as were in fair condition were reset in true position; all of which were hauled and set by the Cumberland Construction Company at $5 each, and $1.50 each for small groove stones.

The work of marking the line was finished September 13, and 23 official plans to accompany the special report to the legislature, in accordance with the act, have been prepared.

As in last year's survey, Mr. Richard H. Tingley has represented the Rhode Island Commission in the supervision of the work, and has co-operated with this office in securing the best results.

Mr. Eugene E. Peirce was in charge of the triangulation, and all matters of detail relating to the field party until the work was well advanced, when he was assigned elsewhere.

Mr. John J. Dalton was employed on the inspection of setting the bounds.

The line is now well marked at 138 points, distributed through its entire length of about 46 miles, while the area of each State remains the same.

New York Boundary Line.

The survey of this boundary line was begun in June, 1897. This survey established a long base line over the summits of the mountains,

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covering a distance of over 38 miles between two intervisible points. Intermediate stations had been successfully lined in and signals erected, and the line from the northwest corner of Connecticut to the summit of Round's Mountain was cleared of all timber and brush, a distance of 37½ miles, when last season's work ended.

About 32 miles of the line had been chained with a steel tape, and the profile topography taken with the stadia.

The work of this year was resumed at points in the line where the work was abandoned in 1897, and under a similar arrangement as last year, except that Mr. Eugene E. Peirce was assigned as field assistant in charge on the part of Massachusetts, in place of Mr. Sidney Smith, on account of the latter's employment elsewhere.

One party under the New York assistant proceeded to cut out the line from Round's Mountain to the northwest corner of Massachusetts. The party under the Massachusetts assistant proceeded with the chaining from Mount Lebanon northerly, from a point just east of Shaker Village, being about 21⅛ miles from the north end of the line.

Previous to the chaining, however, the points on the base line were examined for alignment,

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and a portion of the line transited northerly from Mount Misery.

The field work was begun on the 23d of June.

The cutting and chaining progressed without interruption until the northwest corner of Massachusetts was reached, on the sixth day of August. This corner was found to be 62 feet west of the old bound. The base line extended about one-quarter of a mile northerly to a point called Pownal, which could be seen from the triangulation station at Jim Smith Hill.

During the running and chaining of the line many additional stone piles were found, and identified as points of the old line. They were found sometimes on one side of the base line and sometimes on the other, but very near it. A few were found directly on the line.

A preliminary plan, showing these old marks, made it apparent that the base line of survey was practically the line established by the commissioners of 1787; and, orders being received to proceed at once with the monumenting of this line, arrangements for the purchase and delivery of the necessary bounds were made at once.

Forty-four new 12 by 12 inch granite monuments, cut to specifications approved, were fur-

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nished by Mr. D. H. Reed of Fitzwilliam, N. H., at $11 each f. o. b. at quarry.

Thirty-seven mile stones, 12 by 12 inches by 5 feet were furnished by the State of New York from Leete's Island, Conn.

Twenty-nine iron posts were furnished by the Chelmsford Foundry Company, at $2.60 each f. o. b. at Chelmsford.

While the monuments were being cut, the work of checking the chaining of the line, perfecting the field notes and determining the correct stationing of the line was carried on, so that the bounds could be set in their proper positions for the mile points as required.

The zero of the line was taken at the point where Connecticut, Massachusetts and New York join.

The preliminary computations show that the error in chained distances, as tested by the triangulation, was about one foot per mile.

Alignment.

From the point on Mount Misery northerly the alignment was all done by the transiting method. The instrument at Mount Misery was set on Harvey for a backsight, and by transiting a point was set on Rhode's Pinnacle and

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also on Berlin Mountain (Macomber), in each case taking the mean of 12 observations.

The instrument was then taken to Berlin and backsighting on Mount Misery, two points were set on Jim Smith Hill, one on each summit.

Finally a point was set at △ Pownal, Vt., about a quarter of a mile north of the northerly line of Massachusetts, as the northwest corner was not visible from Jim Smith Hill.

The preliminary field computations of the triangulation show all these points to be on the base line of survey from Alander to Misery produced, or on a perfectly straight line.

The total length of the line from Boston Corner to the northwest corner of the State was found to be shorter than the distance given in the report of the commissioners of 1787. The large "red or black oak tree," described as marking the northern extremity of the 1787 line was not found.

The work of setting the monuments on the northerly portion was executed by an agreement between your Board and the Cumberland Construction Company, — Mr. Kenneth MacKay, manager, — who furnished four men, derrick, tackle and all the necessary appliances, except teams. A team and stone wagon for carting the bounds from the railway stations to their positions along

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the line, and for carrying the men, tools and instruments to the line while the work of setting the bounds was in progress, was furnished, by agreement, by Mr. W. H. Atwater of Garfield, N. Y.

Between September 15 and October 17, 47 bounds were set in place, the work being continuous except when delayed by rain.

The remaining bounds, 8 in number, which had not arrived at their destination on the completion of the above work, were set between October 24 and 27. Assistant Peirce and one man to represent New York inspected the setting of all bounds. The bounds set on the Massachusetts portion of the line were as follows: —

Granite monuments, 12 by 12 inches by 9 feet,	18
Granite monuments, 12 by 12 inches by 5 feet,	20
Iron posts, 5 feet in length,	14
Old bounds reset,	3
Total,	55

The old monuments reset were as follows: —

Road stone at Shaker Village Road, marked 1818 — Mass. — N. Y., with a long inscription.

Granite monument marking the corner of Berlin, Hancock and Williamstown, 5½ feet long, set in concrete masonry.

The granite monument at the northwest corner of the State, marked Mass. — 1896 — N. Y.

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— 1898 — Vt. — 1896, 14 inches square and 8½ feet long, was moved westerly 62.25 feet on the northerly line of the State produced.

The marking of the 23d mile point was omitted, as it fell but 8.9 feet north of the road stone. The average cost, set, was: large granite bounds, $28; mile stones, $22.50; iron posts, $17.

In addition to the above bounds set, 3 iron gas pipes were set on the line, being driven into holes drilled in ledge, one on Rhode's Pinnacle, one on Berlin Mountain and one on Jim Smith Hill.

The monuments for the southerly portion of the line were all delivered at or near their destination by the New York party, and a few of them were set in place.

In addition to the hubs set on the line at several points, the line was temporarily marked by iron gas pipes driven into the ledge, or by a hole drilled into same, all of which are properly referenced to witness points near by, thus insuring the preservation of the line on the ground until the bounds are set. The signals for alignment were left in place.

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The following table shows points on the line which have been accurately determined in position by triangulation: —

	Distance (Miles).
Northwest corner of Connecticut,	.0
Southwest corner of Massachusetts,	.5
Angle at Alander Mountain,	3.1
Mount Prospect (M — N Y),	7.1
Mount Fray (M — N Y),	8.2
Mount Harvey (M — N Y),	19.3
Perry's Peak (M — N Y),	27.3
Round's Mountain (M — N Y),	37.4
Mount Misery (M — N Y),	40.9
Berlin Mountain (M — N Y),	46.4
Jim Smith Hill (M — N Y),	49.6
Northwest corner of Massachusetts,	50.3

Additional stations on the base line of survey, determined by triangulation, on the State line produced: —

Alander Mountain (M — N Y), 384 feet south of angle on "Hogeboom Line."

Boston Corner, 13,697 feet south of angle on "Hogeboom Line."

Pownal, 1,432 feet north of northwest corner of State.

Mr. Chas. H. Flanigan has represented the State Engineer of New York in the supervision of the survey, and has co-operated with Mr. Peirce in this work of unusual interest.

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Massachusetts-Connecticut Boundary Line.

Being directed by your commission to make a preliminary examination as to the present condition of the monuments or marks defining the boundary line between Massachusetts and Connecticut, I have to report that an examination of the greater part of the line has been made by Assistant Eugene E. Peirce and myself, and the line has been found to be in an unsatisfactory condition.

The portion of the line east of the Connecticut river is marked at most of the angles named in the report of the commissioners who surveyed it and set the bounds in 1826.

Many of the monuments found are either defaced or broken, and all are too short to withstand the effects of frost. Many are leaning badly, or could easily be displaced and the point lost. Only a few are missing.

At road crossings and angles, dark-colored, dressed sandstone bounds, 5 feet in length, were set, leaving from 1¼ to 3 feet above the surface of the ground, generally about 2½ feet. These bounds do not seem to have been cut to any absolute size, but averaged about 10 inches on the north and south faces and 6 inches on the east and west faces. The letter "C" is cut on

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the south face and "M" on the north face. The bounds were usually set on the easterly side of roads, and to-day stand fairly firm, but invariably leaning; the corners, tops and faces are badly broken and defaced.

At points where two Massachusetts or two Connecticut towns join at the State line, granite or sandstone bounds, 1½ to 2½ feet in height and about 9 inches in width, have been set, evidently by town authorities, since the line was run in 1826. There is no similarity in these "three town corners," but each is marked by letters cut in the faces.

There are 75 points on this portion of the line that require to be marked, including all angles, all town corners, prominent summits, railroads and highways. Of this number, 6 points are not marked at all at present.

The line is very nearly straight, and requires no material alteration. It should be run out on the ground, to ascertain the location of road stones. This can be done at a reasonable cost, being mostly an open country, there being a few prominent summits that command long stretches of view.

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Portion West of the Connecticut River.

The portion of the line west of the Connecticut river is in a far worse condition. The line is older by twenty-three years, having been marked in 1803. There are a number of slight angles in the line, and the markers at the corners cannot all be found. As over 50 per cent. of the bounds at the highways are missing, it is evident that the line should be re-marked. It could at the same time be straightened enough to make it consist of a few straight lines, incidentally abandoning the high-water line of Congamuck Pond at the "Southwick Jog."

The notes reported by Assistant Peirce contain the following statements: —

Bounds similar to those on the eastern section were used in marking points where the State line crossed highways west of the river; they were of dark-colored sandstone, 5 feet in length, dressed 12 by 9 inches for a distance of 2½ feet from the top, and set about 2½ feet into the ground. Letters were cut on the wider faces of the stone, "C State Line" on the south, and "M State Line" on the north, with "1803" cut in addition below on one face or the other.

Of 50 road crossings on this section, less than

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one-half are monumented, the above being the type of bound used in practically every case. At "three town corners" the Massachusetts and Connecticut town authorities have, except in one instance, erected some sort of a mark, the following being a list of those found: —

A granite bound, $2\frac{3}{4}$ feet in height, 8 by $8\frac{3}{4}$ inches, lettered "S" and "G."

A common field stone, $1\frac{7}{8}$ feet in height, $5\frac{1}{2}$ by 13 inches, lettered "S" and "90."

A rough field stone, 1 foot high, $8\frac{1}{2}$ by $10\frac{1}{2}$ inches, lettered "T L."

A rough field stone, $\frac{7}{8}$ foot high, 12 by 6 inches, lettered "T" and "G."

A stake in a stone pile.

A field stone, $3\frac{1}{2}$ feet high, 24 by 8 inches, lettered "N" and "S."

A rough dressed granite post, $3\frac{3}{4}$ feet in height, 9 by 6 inches, lettered "NM" and "S 1863."

A few stones piled against twin oak stumps.

The line from the river westward to the New York boundary line, with the exception of the "Southwick Jog," is practically straight, 14 extremely small angles being shown on the 1803 plan. Of these, only one could be found, the markings of the others having been effaced, as far as could be ascertained. Three road stones were either broken at the ground or sunk so

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that their tops were at the surface; one was broken in two and the pieces lay on a bank beside the road 11 feet apart; another had been broken and the top removed from its original position (according to the notes of the original survey) on the bank of Sandy Brook, and set on end in a pile of small stones on the westerly side of the next road west.

Usually the road stones were placed on the easterly sides of the highways.

The whole line should be surveyed, and the location of all corners and summits determined by triangulation.

The position of road stones should be tested, and the stones moved on to line wherever wrongly placed.

The estimated cost of furnishing and setting 130 new 12 by 12 inch granite monuments, re-setting 45 old granite monuments, locating and straightening the line, and making the final plans and reports, etc., is $14,000, or $7,000 for each State.

Town Boundary Work.

The primary triangulation which is to form the basis of all town boundary work has now been carried across the entire State. The field

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work this year has been confined to establishing such stations in Berkshire County as were necessary to control or locate the New York boundary line. This was the more easily accomplished as the work of the previous year was laid out with this in view, and the computations and adjustments of the field observations were made preparatory to this extension.

Assistant James B. Tolley was assigned to this work as soon as the boundary line had been agreed upon, and it was definitely known what points were to be determined. With Greylock, French's Hill, Becket, Jackson Hill and other strong stations already observed, 21 new stations were occupied and located, of which 12 were on the boundary line and others near to it. Only preliminary field computations have been made to locate these points for immediate use for the purpose of checking chained distances. The final and adjusted values are now being determined, and the results will be of engineering interest on account of the unusual conditions that exist; viz., a triangulation system extended across the State and connected with an independent system, and with points on a straight line over 50 miles in length. The straight line offers unusual advantages for future study of magnetic declination. The names

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of some of the principal points located are given in the report on the New York line.

The boundary work proper has been devoted to the work of revising and completing the surveys of certain towns in Middlesex and Plymouth counties, the main work of which was already done, it being intended to make this work continuous in and around these two localities till both counties are published.

In preparing for publication the data previously collected for the boundary atlases, legislative records have been consulted, and the latest acts and resolves defining the boundaries of each town were closely followed. Natural streams or bodies of water forming a boundary have been surveyed, as ordered by the commission. Two parties were assigned to this work. A few topographical sketches of corners were supplied, or old ones corrected for recent changes.

Assistant James B. Tolley and party revised the boundaries of the following towns in Middlesex and Suffolk counties: —

Melrose,	Chelsea,
Malden,	Revere,
Medford,	Winthrop.
Everett,	

The main work in these towns included the survey of Long Pond in Melrose; the deter-

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mination of bounds mentioned in the acts not previously located in Malden; the survey of Wyllis Avenue and Belmont Street, forming the boundary line between Malden and Everett; also a survey of Creek Head, a small stream dividing Malden and Medford, and the determination of a few bounds, one of which had been moved 102.6 feet. All of the bounds were photographed by Mr. F. E. Bowman.

The locations of the bounds on the new line between Boston and Brookline, from Chestnut Hill Reservoir to Commonwealth Avenue near Naples Road, were determined.

The locations of about 50 town corners were determined, and 52 topographical sketches made, and stadia surveys of 9 small streams or highways that formed a part of boundary lines.

This party was engaged the latter part of the season on the primary triangulation in the western part of the State.

Assistant Eugene E. Peirce and party were engaged on work similar to that of the party just mentioned.

A revision of the town of Beverly, in Essex County, was made early in the season, including the re-determination of the Beverly-Wenham line, where the statute called for a corner in what had been considered a straight line. A

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stadia survey of Chubb's Creek and of highways at the Beverly-Manchester line was made.

Boundaries were revised of the following towns in Plymouth County: —

Brockton,	Whitman,
Rockland,	East Bridgewater,
Abington,	West Bridgewater.
Hanover,	

Mr. W. H. Ham conducted the field work on these towns, while Mr. Peirce was on the New York line.

Topographical sketches of 15 bounds were made, and over 30 miles of streams forming boundaries were included in the season's work.

This party spent a portion of the time in completing details of the survey and marking the Rhode Island boundary line.

Assistant W. C. Hawley and party were ordered to determine the location of bounds on the Milford-Holliston line, of which one was reported to have been set about 9 rods from its true position. The work was facilitated somewhat by information obtained from a local engineer. The positions of three old bounds were re-determined, and two new bounds, marked only by stone piles, were also determined, which will give the location of both the Milford-Holliston and Milford-Hopkinton lines. The survey

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made verifies the former location of bounds, and shows that the bound between Milford and Holliston, now marking the southwest corner of Holliston, is 149.7 feet distant from its true position, and one angle in the line is not marked as required by law.

Later, Mr. Hawley continued work on the Northborough-Shrewsbury, Boylston-Shrewsbury, Westborough-Shrewsbury and the Grafton-Shrewsbury lines.

Draughting Division.

Mr. Frank L. Tibbetts, assistant, in charge; Mr. P. S. Yendell and Mr. F. W. Farnum, assistants.

Plans relating to the Rhode Island and New York boundary lines have been made during the year, including three detail field plans of the former and one of the latter. The final plans for the Rhode Island boundary line for filing with the commissioners' report were made in this office, and are 23 in number. They are of double elephant size, and include one general plan to be used as an index to the set. The final plans of the New York boundary line cannot be made until the New York party have set the bounds on the south end of the line.

Plans have been made from the topographical

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surveys of natural boundaries that follow rivers, brooks, roads and ponds. These plans are on a sufficiently large scale to show important details, and to make a proper record of the boundaries that they represent. Seventeen of these plans have been carefully plotted, showing over 30 miles of boundaries. This data will be used in making up the Town Boundary Atlases.

Sixty photographic reductions of shore lines, made and revised by the United States Coast Survey, have been received from Washington, D. C., and from this data coast lines have been drawn on the plans for the boundary atlases of 13 towns.

The town boundary atlases of 7 towns, containing 75 sheets, have been completed.

Boundary Atlases.

Having been directed to prepare for publication the atlases of the 15 towns of which the bounds have been examined in the field this season, the results as draughted are being compared with the laws and records, and a preface inserted, explanatory of the atlas. Part of this work is now in the hands of the printer.

Miss Sara A. Holt, stenographer and typewriter, has been employed in looking up the old records in the archives and State library, and

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in arranging the information required for this work in convenient form for use in making up the atlases. In obtaining this information, this department has been assisted by the courteous co-operation of the officials of the departments of the Secretary of State, public records and the State library.

Office and Computing Division.

Both the local and figure adjustments were made in Washington last winter for 5 important points connected with the eastern scheme of the primary triangulation, and 6 in the central part of the State.

French Hill, in the town of Peru, an old station made by Simeon Borden, had not up to this time been considered a well-determined point. It is favorably located in the centre of hills commanding a wide extent of view. From it 10 to 12 important stations can be seen. From the observations of 1897 this point was made as strong as any in the system. Its new position varies about one foot from the old one.

In the western portion of the State several stations controlling the Massachusetts-New York boundary line were also adjusted, and their positions computed last spring for use in this year's

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work. Assistant Tolley has been in charge of this portion of office work.

The general computations in the office have been made by Mrs. Edna M. Peirce and Mr. William C. Hawley.

The computations made this year, in addition to the regular town boundary work, include the computation of points on the Massachusetts-Rhode Island line, on the Massachusetts-New York line, and some preliminary work to aid in the reconnoissance of the Massachusetts-Connecticut line.

During the months of June and July considerable time was spent in preparing the official documents, computations, maps and plans for removal from the Commonwealth building to the new office in the State House, and in filing these documents and plans after removal.

In the regular work of the town boundary survey the following computations have been made: —

Determination of the Beverly-Wenham town line.

Determination of the lines of the new town of Westwood.

Determination of the boundary lines of 11 towns on the "Marlborough sheet" (requested by the United States Geological Survey).

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Preliminary investigation and reduction of survey of the Milford-Holliston line.

Base lines of the surveys of 5 rivers and 1 street computed.

Many miscellaneous computations have been made, and triangulation stations and corners were plotted and checked on town boundary atlases, as required, in the draughting room.

The boundary lines of 114 towns, comprising 9 sheets of the topographical map of Massachusetts, including the metropolitan district and the "Marlborough sheet," were plotted, many of which are to be used as bases of control by the United States Geological Survey in their revision of these sheets, and such other assistance rendered as would facilitate this important work.

Sale of Atlas Sheets.

Under provisions of chapter 57 of the Resolves of 1890, 22 atlases, 1 folio, 3,174 single sheets of the State topographical map and 8 wall maps have been sold, and the sum of $265.82 received from the sale of maps has been deposited with the State treasurer.

Under provision of chapter 95 of the Resolves of 1891, 59 portfolios of the State map have been gratuitously distributed, all with two ex-

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ceptions having been sent by request to the free public libraries of the State.

The reduction in the price of the atlas sheets to 5 cents each has increased the demand for them, but has reduced somewhat the total amount of money received.

All of the State libraries have not as yet received the atlas to which they are entitled under chapter 95 of the Resolves of 1891. Copies are sent to such libraries as are entitled to them, when the applications are received.

The office is in constant receipt of applications from local engineers and others for information and data relating to State work, and the appended list shows the nature of such inquiries.

Respectfully submitted,

HENRY B. WOOD,
Chief Engineer.

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Appendix B.

The following data was furnished to engineers and public boards, by request, during the year 1898: —

R. A. Hale, Engineer Essex Locks and Canals Company, Lawrence, Mass.

Geographical positions of Fay's Mountain, Pegan Hill and Nobscot, with the azimuths and distances between them.

Geographical positions of Emery's Barn Cupola and Williams' Barn Cupola, with the azimuth and distance between them.

Metropolitan Park Commission.

Geographical positions of the corners of Wellesley-Newton-Weston and Wellesley-Natick-Weston, with the azimuth and distance between them.

Geographical positions of Chelsea-Everett corners 2, 3, 4 and 5, with the azimuths and distances between them.

True course and distance between Watertown corners 15 and 16.

Ginn & Co., Boston, Mass.

Sketch of the new Dedham-Westwood boundary line for Ginn & Co.'s map of Massachusetts.

Rice & Evans, Civil Engineers, Boston, Mass.

Geographical positions of two corners on the Acushnet-Freetown line, and of three corners on the Acushnet-Fairhaven line.

State Board of Health.

Tracings of contours and roads from the original topographical map of Massachusetts in the town of Peabody.

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NEWCOMB B. TOWER, Clerk of Selectmen, Cohasset, Mass.

Tracings of the boundary lines of the town of Cohasset, and of the plan showing the changes in boundary made in 1897; also the geographical positions of the 13 corners of the town, with the azimuths and distances between them.

H. R. THAYER, C.E., Boston, Mass.

Geological position of the corner of Blackstone-Bellingham-Rhode Island, and the bearing from said corner to Blackstone-Rhode Island 1 and to the corner of Mendon-Blackstone-Bellingham.

ROBERT ROGERS, Norwood, Mass.

The azimuth and distance between the Norwood churches and the Westwood Unitarian Church, and Blue Hill.

Courses and distances between the twenty-nine corners of the town of Norwood.

HARRISON L. HOUSE, C.E., West Hanover, Mass.

Copy of the notes of the Taunton River survey in the vicinity of the State Farm pumping station, Bridgewater, Mass.

EDMUND H. HEWINS, Boston, Mass.

Geographical positions of the following triangulation stations, with the azimuths and distances between them: Blue Hill, Moose Hill, Foxborough Congregational Church and Sharon Unitarian Church.

J. A. TAFT, City Solicitor of Milford, Mass.

True courses and distances between the corners Holliston-Medway-Milford, Holliston-Milford 2, Holliston-Milford 1 and Holliston-Hopkinton-Milford.

HYDE & SHERRY, Civil Engineers, Boston, Mass.

Description of the corners on the Canton-Sharon boundary line; also geographical positions of the Canton-Sharon corners, 4 to 12 inclusive, with the azimuths and distances between them; also geographical positions of the triangulation points Hedley, Hodges and Rabbit.

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Geographical positions of the following triangulation stations, with the azimuths and distances between them: Pond Hill, Redstone Hill, Kendall's Observatory, George, George Hill (north side), Lancaster Congregational Church, Lancaster Unitarian Church, Wataquadock Tower and Clinton.

THEO. P. PERKINS, Chief Engineer's Office, Boston & Maine Railroad.

Geographical positions of the following triangulation stations, with the azimuths and distances between them: Gould's Hill, Smokestack, Will's Hill, Hay, Middleton Congregational Church and Slope.

W. D. HUNTER, Chief Engineer Board of Sewer Commission, Melrose, Mass.

Geographical positions of all the corners of Wakefield and Reading, with the azimuths and distances between them.

UNITED STATES GEOLOGICAL SURVEY.

Geographical positions of 32 triangulation stations, and of all the corners in the "metropolitan district," with descriptions and information concerning them.

SILAS POOLE, Chairman of Selectmen, Sharon, Mass.

Sketch, with courses and distances on the Canton-Sharon town line.

Geographical positions of all the corners of the town of Sharon.

HAYWARD & HOWARD, Civil Engineers, Brockton, Mass.

Courses and distances between Bridgewater corners 5 and 6 and 6 and 7.

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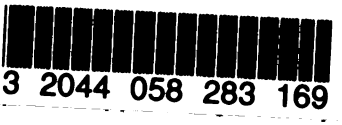
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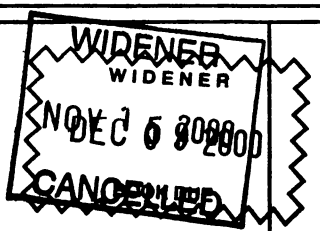

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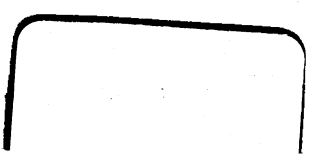

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